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LANDSAT OBSERVATIONS OF OCEAN DUMP

PLUME MOVEMENT AND DISPERSION

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V. Klemas, G. Davis, R. Henry
College of Marine Studies
University of Delaware *et al.*

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Report on Significant Results
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Significant Results

Eighteen LANDSAT images were analyzed to study the dispersion and movement of ocean dump plumes thirty-eight miles southeast of Cape Henlopen, Delaware, at the disposal site for waste discharged from a plant producing titanium dioxide. The discharge is a greenish-brown liquid containing up to 10% acidity (expressed as HCl) and 4% iron as iron chloride salts. The barge which transports this waste is capable of releasing one million gallons of the liquid upon radio-command from a towing tug. It makes several trips to the disposal site per month.

The following preliminary results were obtained:

- a. The frequency of the dumping made it possible for the LANDSAT satellite to image the waste plume in various stages of degradation, ranging from minutes to days after dump initiation. The long visual persistence has been explained by the formation of a suspended ferric floc. Spectrometric measurements indicate that upon combining with seawater the acid waste develops a strong reflectance peak in the 0.55 to 0.60 micron region, resulting in a stronger contrast in the MSS Band 4 than the other bands.
- b. The predominant direction of movement of the waste plumes imaged by the LANDSAT satellite was to the southeast. This appears to be due to the fact that northeasterly winds produce stronger currents than those driven by southeasterly winds and by the thermohaline circulation.
- c. The average drift velocity for surface drogues and the waste plumes as observed by LANDSAT was about 0.5 knots. Drogues released at different depths frequently travelled along different paths, and at different speeds, indicating the presence of strong current shear. During stratified conditions the near-bottom drogues showed very little movement.

d. The waters at the test site were highly stratified and stable in the summer and nearly homogeneous in the winter. A distinct thermocline was observed from June through August, at depths ranging from 43 to 103 feet. During most dumps the acid plume was unable to penetrate the thermocline and reach the bottom.

The current circulation data is being used to assess the movement and dispersion of the acid waste plumes together with wind and weather data. In general, it appears that rapid movement toward shore can occur primarily during storms, particularly northeasters. During such storms, however, the plume is rapidly dispersed and diluted. Therefore, the probability of an identifiable plume containing heavy concentrations of acid waste reaching the shore is quite low.